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"OLD NORWAY"

Die Geologie des südlichen und mittleren Norwegen.

Herausgegeben von Dr. Theodor Kjerulf; autorisirte deutsche Aufgabe von Dr. Adolf Gurlt. (Bonn: Max Cohen und Sohn, 1880.)

IN that rugged northern land where the mingled Atlantic and Arctic tides course round a network of islands, and lave the shores of deep lonely fjords, sending their waters far inland to the very base of snowfield and glacier, the people, with the patriotism of mountaineers, sing enthusiastically of "Gamle Norge"—Old Norway. And well may they sing of a land that by its scenery and climate has moulded their habits of thought, their traditions, their literature, and has knit their bodily frames into that muscular type for which the hardy Norsemen have been famous from time immemorial. Dear Gamle Norge! The sound of its praise awakens a responsive chord in the breast of many a Briton, leading him to reflect how much of the vigour and success of his own countrymen may be due to the fresh blood which came to them from the robust north, and reminding him of the wild creed and spirit-stirring songs which his ancestors shared with their kinsmen of the northern fjords. Well may men speak of "old" Norway. Even as regards human records, its antiquity goes back far enough to merit that appellation. But if we pass to the earlier history of Europe the fitness of the epithet becomes singularly impressive. To that northern region of tableland and valley the geologist looks as the cradle of this continent. The plains of Russia and Germany are formations but of yesterday. The Urals, the Alps, the Pyrenees, the high grounds of Bohemia, Saxony, and Central France have appeared at various widely separated epochs, and have undergone many vicissitudes in a long course of ages. But the uplands of Scandinavia, though they too have not been without their mutations, already existed as land almost at the beginning of those ages which are chronicled in the rocky records of the earth's crust. From the sand and mud washed down from these uplands the formations have been derived out of which, for example, most of the highlands of Scotland, Wales, and Ireland have been built up. So far as we can tell, the earliest land of Europe rose in the north and north-west. The subsequent growth of the continent has been over the tract of shallow sea by which the first land was bounded.

There is thus a peculiar interest in the study of the geological structure and history of Scandinavia. It is in that region that by far the largest fragment of archæan Europe exists and that the data are chiefly to be sought from which the earliest chapters of European geological history must be written. Most cordially, therefore, will all geologists welcome the volume which Dr. Kjerulf has just published for their information. It is by much the most important summary of Norwegian geology which has yet appeared.

In an interesting preface a sketch is given of the progress of geological inquiry in Norway. After numerous private and unconnected researches by natives and

foreigners in different parts of the country, a systematic geological survey of the country was in 1838 projected by Dr. Kjerulf and Bergmeister Tellef Dahll, and on the approval of the plan by the Norwegian Government, was commenced at the national expense. Its main object was to make a geological map of the country with the requisite sections. The Survey was organised very economically under Kjerulf and Dahll, with no special office, no place to store specimens, no laboratory, and no official channel of publication for its memoirs. With praiseworthy enthusiasm the two geologists continued for ten years to work in the field during the brief Norwegian summers, either together or singly, taking with them as volunteer assistants such students of mining and others as chose to accompany them. In 1866 Dahll undertook the investigation of Northern Norway, so that the charge of the Central and Southern provinces then fell to Kjerulf. The latter geologist, with the assistance of other observers, whose share in the work is duly chronicled, has at intervals published maps and sections of the area under his control, and in particular a general map on the scale of one-millionth. As a fit conclusion to the labours of a quarter of a century among the geological formations of Norway, he has published at Christiania a quarto volume with an atlas of plates, giving a concise account of the geological features of the central and southern part of the country.¹ This work is in Norse; but the author, with the view of making it more widely known, has intrusted it to Dr. Gurlt, who has rendered it successfully into German, and has had it republished in a convenient form.

Every student of metamorphism and the crystalline schists must procure Dr. Kjerulf's work. It contains a store of facts of the utmost importance for all theoretical questions in this most interesting and difficult department of geology. At the same time the superficial geology is not neglected. The first part of the volume treats of the loose surface formations—especially of the erratic blocks, moraines, and glacial striæ. These phenomena are illustrated by maps, on one of which—that of the striated rock-surfaces—an explanatory remark affords a characteristic sample of the author's cautious spirit of observation:—"The directions of the striæ are expressed on the map, as in nature, by lines; the observer must himself judge whence they come and whither they go." The second part, devoted to a summary of the geology of the Christiania district, contains a table of fossiliferous deposits, which, extending from the base of the Primordial zone to the top of the Upper Silurian formations, are shown to attain there a thickness of 2,700 feet. There is likewise an important tabular statement of the horizons of the leading organic remains of these older palæozoic deposits. In Part III. a description is given of the "Grundgebirge," or fundamental rocks of Southern Norway. The author shows that though these have sometimes been classed under the general term gneiss, they contain other rocks, especially various schists, quartzites, conglomerates, and limestones, and that gneiss is rather a structure belonging to rocks of different ages than a formation of one geological date. He regards the bottom gneiss as a metamorphic representative of ordinary sedimentary formations, in

¹ "Udsigt over det Sydlige Norges Geologi" (Christiania, 1879).

particular of the so-called "Sparagmite" or fragmental accumulations below the Primordial zone. He believes that the older gneiss may include metamorphosed portions of younger formations, in particular considerable masses of the Primordial rocks. This question in another form is discussed in Part IV., which treats of the geology of Central Norway. To the oldest sedimentary formations, termed the Sparagmite series, a thickness of 2,300 Norwegian feet is there assigned. They consist of sandstones, conglomerates, schists, slates, and limestones. Above them lie the Primordial beds, 2,900 feet thick, composed of quartz-schists, mica-schists, "blue-quartz," sandstones, clay-slates, and limestones, among which are found the earliest fossils (*Dictyonema*, *Olenellus*, &c.). Above these rocks the unfossiliferous red sandstones and conglomerates of the west coast (? Old Red Sandstone), long since described by Naumann, close the geological record until the deposits of the Glacial period. Dr. Kjerulf brings forward many facts regarding the metamorphism of the older palæozoic rocks in Central Norway, and traces with clearness the passage of these rocks into schistose and gneissose masses as they approach the larger areas of granite. Part V. is devoted to a brief exposition of the geology of the Trondhjem district. Part VI. discusses the lithology of the cruptive rocks. The various species and varieties of granite, syenite, porphyry, gabbro, greenstone, olivine-rocks, &c., are here described with remarkable succinctness alike as to their composition and geological relations. Considering the meagreness of the official equipment of the Geological Survey, this portion of their work must be admitted to be specially creditable to the Norwegian geologists. In Parts VII. and VIII. information is given regarding the structure of rocks and mineral veins. Some nature-printed illustrations of rock-structure here inserted are interesting. Slices of foliated, graphic, and porphyritic granite, etched with hydrofluoric acid, have allowed the more durable quartz to print its figure upon paper, and the impression has then been photographed on wood and cut into a woodcut. Some figures are also added to show the coexistence of organic remains (graptolites, corals) with crystals of chistolite, vesuvianite, and other minerals in metamorphosed Silurian rocks.

A useful feature in the German translation is the addition of an index, which is wanting in the original, but which would have been still more acceptable had it been even fuller than it is. The numerous woodcut sections enable a reader to follow the local descriptions in the text. But the addition of a good geological index-map, such as that which accompanies the Norwegian volume, would have been of much service, and might perhaps have been given without any very serious increase of price. But this is a defect which every geological reader, at a little cost to himself, can remedy by obtaining the general map. He will find in Dr. Gurlt's version of Dr. Kjerulf's memoir an invaluable compendium of Norwegian geology, and will probably be induced to set out himself to make a personal exploration of the sections which are therein described. Should he be induced so to do he will doubtless come to look back on his tour in Norway as one of the most instructive as well as delightful of all his geological rambles.

ARCH. GEIKIE

EUCALYPTOGRAPHIA

Eucalyptographia; being a Descriptive Atlas of the Eucalypts of Australia and the Adjoining Islands. By Baron F. von Mueller, K.C.M.G., M. and Ph.D., F.R.S., Government Botanist for the Colony of Victoria. Decades 1 and 2. (Melbourne and London, 1879.)

MATERIAL for the issue of this atlas was accumulated at Melbourne now over thirty years ago, and the study of this fine group of the myrtles has been carried on ever since, as opportunities presented themselves by Dr. Mueller. Still the subject was so large and the perplexities surrounding it so many that even now he offers his observations in these decades as only fragments toward a some day complete monograph. The difficulties surrounding the study of this group are many. There is the large number of species, the genus *Eucalyptus* being surpassed in this respect only by *Acacia*. The resemblance of many specific forms is apt to deceive one; the fruits, and more especially the flowers, are often far out of the reach of the ordinary traveller, even though he might in his enthusiasm not object to climb for a considerable height into the trees; and then the species themselves are widely distributed over the whole of the Australian continent and Tasmania, some even extending to the Indian Ocean Islands, though, it may be added, none occur in New Zealand.

Mr. Bentham's grouping of the species has been, with some trifling modifications, adopted by the author, and the Government of West Australia has borne the expense of issuing these two decades, which contain descriptions of some of the most important timber trees of the great western colony. It is to be hoped that some of the other colonial governments may follow this good example, and so help on the publication of the work. Perhaps even our own Royal Society might see their way to help it by a grant in aid out of the fund placed at their disposal by Parliament for promoting scientific research.

The economic value of these eucalypts needs scarcely to be insisted on. Not only do they yield excellent hard timber, but as products we find enumerated oils, tars, acids, dyes, tan, and potash. What magnificent forest trees are to be found among them will appear from the description of some of the species figured in these parts. One (*E. gonicalyx*) is mentioned as growing on low or hilly woodlands up to about 3,000 feet, and attaining in some of the forest valleys a height of 300 feet, with a stem diameter of not rarely six feet, and sometimes even ten. The timber of this species is described as hard and tough, exceedingly durable, lasting well when buried underground, not warping, and difficult to split. Another species (*E. leucoxylon*) known as the iron bark tree, or white gum tree, grows to a height of 200 feet, has a timber of great hardness, durability, and of extraordinary strength. On being burnt for charcoal it yielded 28 per cent. of superior stuff, 45 per cent. of crude pyroligneous acid, and 6 per cent. of tar. An excellent packing paper has been prepared from the inner layers of the bark, as can indeed be done from the inner bark of most eucalypts, and the leaves yield a volatile oil to the extent of about 1 per cent.

The genus thus abounding in useful products is not